

3.1.10 Aquatic Ecology

The aquatic resources within the vicinity of the Moab tailings pile are associated with the Colorado River. The river has historically had seasonal variations in flow and temperature that are based on natural flow cycles. Aquatic species in the river have adapted to physical and chemical conditions that fluctuate naturally, both seasonally and daily. These variable conditions include river flow, bottom scouring by sand and silt, temperature, sediment loading, chemical composition, and salinity (NRC 1999).

The Moab site is near river mile 64 on the Colorado River in a transition zone between two geomorphically distinct reaches. River miles on the Colorado River have been designated for use in research programs; the beginning of the designation (mile 0) is at the confluence of the Green River and the Colorado River (Belknap and Belknap 1991; Osmundson et al. 1997). The Colorado River upstream of the site is predominantly sand bedded with a few cobble bars. Downstream of the site, the river is sand bedded with sandbars and stabilized islands. Much of the shoreline near the site has been stabilized by tamarisk, an invasive species, or stabilized with riprap. The tamarisk can form cutbanks that erode to some degree with each large flood. The shoreline at the Matheson Wetlands Preserve opposite the site has been diked and is heavily colonized by tamarisk (NPS 2003).

The State of Utah has classified the river segment adjacent to the Moab site as protected for warm-water species of game fish and other warm-water aquatic life, including necessary aquatic organisms in their food chains. This river segment has also been designated as critical habitat (50 CFR 17.95) for four federal endangered fish species. Detailed information concerning habitat for these species is addressed in Appendix A1, “Biological Assessment.”

Macroinvertebrates (i.e., chironomids and oligochaetes) are thought to dominate the benthic community of the main channel of the Colorado River near the Moab site (NRC 1999, USGS 2002). Backwater areas, such as the wetlands formed by periodic inundation of the floodplain just downstream and across the river from the Moab site, may support a much more diverse and more productive benthos. Similarly, rooted macrophytes (i.e., plants), along with algae and zooplankton, flourish in the backwaters that may provide suitable habitat but are almost nonexistent in the main channel (NRC 1999). The backwaters and inundated floodplains often serve as important nurseries and forage suppliers for fish, including the endangered Colorado pikeminnow (Valdez and Wick 1983). Fish species known or believed to be present in this reach are listed in [Table 3–9](#). This list includes four federal endangered species, one state threatened species, and two state species of special concern.

Many components of the upper Colorado River ecosystem have undergone dramatic changes during the last several decades. An additional important force for change has been the sometimes accidental, but often deliberate, introduction of nonnative fish species into the river, including carp, channel catfish, various minnow species, and largemouth bass (NRC 1999). These introductions, in concert with the physical and chemical alterations of the river, may have contributed to the decline of the native fish populations (Trammell and Chart 1999; NRC 1999; Muth et al. 2000).

Table 3–9. Fish That May Occur in the Colorado River Near the Tailings Pile

Common Name	Scientific Name	Status
Roundtail chub	<i>Gila robusta</i>	N, ST
Humpback chub	<i>Gila cypha</i>	N, FE, SE
Bonytail	<i>Gila elegans</i>	N, FE, SE
Colorado pikeminnow	<i>Ptychocheilus lucius</i>	N, FE, SE
Longnose dace	<i>Rhinichthys cataractae</i>	I
Speckled dace	<i>Rhinichthys osculus</i>	N
Fathead minnow	<i>Pimephales promelas</i>	I
Carp	<i>Cyprinus carpio</i>	I
Red shiner	<i>Notropis lutrensis</i>	I
Sand shiner	<i>Notropis stramineus</i>	I
Flannemouth sucker	<i>Catostomus latipinnis</i>	N, SP
Bluehead sucker	<i>Catostomus discobolus</i>	N, SP
Razorback sucker	<i>Xyrauchen texanus</i>	N, FE, SE
Channel catfish	<i>Ictalurus punctatus</i>	I
Black bullhead	<i>Ictalurus melas</i>	I
Rio Grande killifish	<i>Fundulus zebrinus</i>	I
Largemouth bass	<i>Micropterus salmoides</i>	I
Green sunfish	<i>Lepomis cyanellus</i>	I

Sources: NRC 1999; Trammell and Chart 1999.

N = native to upper Colorado River; ST = State listed threatened species; FE = federally listed endangered species; SE = State listed endangered species; I = introduced species; and SP = State species of special concern

As reflected in the list of species in Table 3–9, as least as many exotic species as native species of fish are now established in the Colorado River.

The roundtail chub, *Gila robusta*, a Utah state-listed threatened species, is a large minnow native to the Colorado River system. It is most often found in pools and eddies near strong currents in the Colorado River and its large tributaries. These chubs eat terrestrial and aquatic insects, mollusks, other invertebrates, fish, and algae. The species spawns over areas with gravel substrate during the spring and summer. Eggs are fertilized in the water, then drop to the bottom where they adhere to the substrate until hatching about 4 to 7 days later (UDWR 2003a).

The flannemouth sucker, *Catostomus latipinnis*, and the bluehead sucker, *Catostomus discobolus*, are considered Utah state species of concern because of recent population reductions. Both species are benthic fish that primarily eat algae. The flannemouth sucker spawns in streams over gravelly areas during the spring and early summer and is often found in deep pools of slow-flowing, low-gradient reaches. The bluehead sucker spawns in streams during the spring and summer. Fast-flowing water in high-gradient reaches of mountain rivers has been identified as important habitat for the bluehead sucker (UDWR 2003a).

3.1.10.1 Aquatic Species Listed in the Endangered Species Act

Four endangered fish species—the Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and bonytail (*Gila elegans*)—are endemic to the Colorado River basin. The Colorado River near the Moab site has been designated as critical habitat (50 CFR 17.95) for all four federal endangered fish species. Detailed information concerning habitat and critical life-history phases for these species is presented in Appendix A1, “Biological Assessment.”

Colorado Pikeminnow

The Colorado pikeminnow, a large fish-eating fish belonging to the minnow family, was once abundant and widely distributed in the Colorado River basin. Pikeminnow less than 2 inches in total length prey on small aquatic invertebrates in side channels and backwaters; juveniles between 2 and 8 inches total length, still in the backwater nursery habitat, eat invertebrates and other fish; pikeminnow greater than 8 inches total length prey mainly on other fish (Muth and Snyder 1995).

Adult pikeminnow use a variety of habitats after spawning, including eddies, backwaters, and shorelines. In the spring and early summer, the adults use shorelines, floodplain habitats, flooded tributary mouths, and lowlands inundated during spring floods (Tyus 1990; USF&WS 2002a). The pikeminnow spawn on gravel beds in whitewater canyons during the period of declining flows in June, July, or August (Tyus and Haines 1991; Muth et al. 2000; Tyus 1990). During the spawning season, adults have been reported to migrate up to 200 miles upstream or downstream to reach spawning areas (Tyus 1990). After hatching, larvae drift downstream, where they are entrained in backwater nursery habitats (Tyus and Haines 1991). Young Colorado pikeminnow remain near the nursery areas for the first 2 to 4 years of life, then move upstream and establish home ranges (Osmundson et al. 1998). Larval pikeminnow (0 to 1 year) show a preference for secondary channel habitats (Trammell and Chart 1998; Rakowski and Schmidt 1996; Day et al. 1999), and they are primarily found in low-velocity waters, which include backwaters (Tyus and Haines 1991; Trammell and Chart 1998). In the fall, they use backwater habitats that are deeper and more persistent than other habitats (Trammell and Chart 1998; Day et al. 1999). These backwaters are created when a secondary channel is cut off at the upper end but remains connected to the river at the downstream end. These areas are considered crucial for overwinter survival of the larval and juvenile fish (Trammell and Chart 1998).

There are 600 to 900 adults in the upper Colorado River (USF&WS 2002a). The two known spawning areas in this reach of the river are near Grand Junction, Colorado, and in the lower Gunnison River (USF&WS 2002a). Fish and juveniles aged 0 to 1 year are found in the upper Colorado River downstream of Palisade, Colorado, to Lake Powell, Utah (USF&WS 2002a). The Moab site is located on river mile 64 and is within the habitats documented to contain current populations of Colorado pikeminnow. Low numbers of Colorado pikeminnow (between 1 and 28 fish) were consistently collected from 1986 to 1996 between river miles 68 and 49 (USGS 2002). Both adults and subadults were collected in Moab Wash and directly below the tailings pile (USGS 2002). As many as 53 young-of-the-year pikeminnow were captured between river miles 48 and 84 (Osmundson et al. 1997). In a mark-recapture study of adult pikeminnow in this reach, 21 of 51 fish (41 percent) were caught between river miles 57 and 65 (Osmundson et al. 1997). Surveys in 1992 to 1996 by Trammell and Chart (1998) found adult and larval pikeminnow between river miles 55 and 65. In addition, pikeminnow are known to use the main channel for spawning migrations and the backwater area of the Matheson Wetlands Preserve as important nursery habitat (NRC 1999). During periods of inundations, the lower Moab Wash and the riparian woodland near the toe of the pile potentially provide habitat for pikeminnow and razorback suckers (NRC 1999). Other backwaters and eddies occur in this reach during periods of relatively low flow and also serve as nurseries (NRC 1999).

As part of the Interagency Standardized Monitoring Program¹, pikeminnow nursery habitat was sampled each fall (1986–2002) between river miles 53.5 and 63.5. The area surveyed began at or near the Moab site (river mile 64) and continued downstream about 10 miles. The purpose of this sampling was to determine relative abundance and distribution of young-of-the-year Colorado pikeminnow. The sampling protocol required sampling two habitats every 5 miles. Sixty backwater locations were sampled between 1986 and 2002, of which 13 were between river miles 61 and 63.5. Five of the 13 backwater areas sampled contained a total of 83 young-of-the-year pikeminnow, composing 24 percent of the total pikeminnow captured in this reach (river miles 53.5 to 63.5) during the sampling (UDWR 2003b).

From 1992 to 1996, 13 flyovers were conducted to determine backwater habitat in this reach (river miles 53.5 to 63.5).

A field visit with UDWR on December 19, 2001, identified areas that may serve as preferred habitat when backwaters are present. These areas begin at the mouth of Moab Wash and extend approximately 1,200 ft south (Hudson 2001). Within this area, three locations (Figure 3–17) extending about 600 to 800 ft south of the wash were tentatively identified as having the greatest potential for habitat preferred by young-of-the-year fishes. Because natural processes can physically alter the characteristics of river channels, the exact location of preferred habitat can change seasonally or annually. Part of the channel to the west is completely inundated during an average spring runoff in April and May when the river flow is greater than approximately 15,000 cfs. Preferred habitat for young-of-the-year fishes develops in the channel as the river recedes below 15,000 cfs in May and June and the sandbar area becomes exposed. As the river level further declines in the fall, the backwaters in the channel become isolated from the river at approximately 5,000 cfs and evaporate to dryness. Habitat availability and quality depend upon the time of year, changes in river structure, and water level.

USF&WS has defined physical characteristics of preferred habitat to include (1) warmer backwater and slow-moving eddies, (2) a sandy/silty substrate, and (3) water depths of less than 2 ft. However, habitat criteria can be less than optimal if other factors, such as food supply, are attractive. Preference parameters can vary significantly and are not prescriptive.

Razorback Sucker

The endangered razorback sucker is one of the most imperiled fish in the basin. It exists naturally as only a few disjunct populations or scattered individuals (Minckley et al. 1991; Muth et al. 2000). Lack of recruitment sufficient to sustain populations has been mainly attributed to the cumulative effects of habitat loss and modification caused by water and land development and predation on early life stages by nonnative fishes (Hamilton 1998; USF&WS 1998; Muth et al. 2000).

Razorback suckers are known to spawn on gravel bars and may also spawn in backwaters (NRC 1999). In the past, they have been observed spawning in early and mid-summer within 2 miles upstream of the tailings pile (NRC 1999). This type of preferred habitat develops in the channel as the river recedes below 15,000 cfs in May and June and the sandbar area becomes exposed. The razorback sucker may be found almost anywhere in the river, including slow runs

¹ This program is a consortium among the U.S. Fish and Wildlife Service; Bureau of Reclamation; Western Area Power Administration; the states of Utah, Colorado and Wyoming; the water user community; and environmental interests (<http://www.desertfishes.org/na/catostom/xyrauche/xtexanus/xtexanus.html>).

in the main channel, inundated floodplains and tributaries, eddies and backwaters, sandy bottom riffles, and gravel pits (USF&WS 1998). Young razorback suckers require nursery habitat with warm, shallow water such as tributary mouths, backwaters, or inundated floodplains (Modde 1996; Muth et al. 2000). During periods of inundation, the lower Moab Wash and the riparian woodland near the toe of the pile potentially provide habitat for pikeminnow and razorback suckers (NRC 1999). The Matheson Wetlands Preserve area is also potential nursery habitat for the razorback sucker (NPS 2003). For purposes of this EIS, it is assumed that the razorback sucker may be present in the project area.

A limited number of adults have been found in the upper Colorado River since 1974 (USF&WS 2002b). Many of the adults captured during studies have been found in two abandoned gravel pits in Grand Valley, Colorado, just upstream and downstream of the confluence with the Gunnison River (USF&WS 2002b). No young razorback suckers have been captured anywhere in the upper Colorado River since the mid-1960s (USF&WS 2002b; USGS 2002; NPS 2003).

The diet of all life stages is varied and includes invertebrates, zooplankton, phytoplankton, algae, and detritus (Behnke and Benson 1983; Marsh 1987; Muth et al. 1998, 2000).

Humpback Chub

The humpback chub, a large cyprinid fish, prefers deep canyons with swift water and rapids (USF&WS 2002c; Muth et al. 2000). Adults require eddies and sheltered shoreline habitats maintained by high spring flows. These high spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, and form gravel and cobble deposits used during spawning. Young require low-velocity shoreline habitats, including eddies and backwaters, that are more prevalent under base-flow conditions (USF&WS 2002c).

Historical abundance of the humpback chub is unknown, and knowledge of historical distribution is incomplete (Muth et al. 2000; USF&WS 2002c). The species exists primarily in relatively inaccessible canyons of the Colorado River Basin and was rare in early collections (USF&WS 2002c).

Humpback chub move substantially less than other native Colorado River fish. Radiotelemetry and tagging studies consistently show that respective humpback chub populations remain in specific river locations.

Five individuals were collected from a reach about 19 river miles downstream of the Moab site, possibly associated with populations upstream of the Moab site in Westwater Canyon and Black Rocks (NRC 1999; Valdez and Williams 1993).

Six extant wild populations are known in the Upper Colorado Basin: (1) Black Rocks, Colorado River, Colorado; (2) Westwater Canyon, Colorado River, Utah; (3) Yampa Canyon, Yampa River, Colorado; (4) Desolation/Gray Canyons, Green River, Utah; (5) Cataract Canyon, Colorado River, Utah; and (6) Colorado River in Marble and Grand Canyons and the little Colorado River, Arizona (USF&WS 2002c). The nearest downstream population occurs in Cataract Canyon (43 miles downstream of the Moab site) (USF&WS 2002c). UDWR, in cooperation with USF&WS, plans to reintroduce the humpback chub into its historical range upstream of the site in the near future.

Bonytail

The bonytail uses mainstem river channels as well as inundated riparian areas. Currently, no self-sustaining populations of bonytail exist in the wild, and few individuals have been caught throughout the Upper Colorado Basin (USF&WS 2002d). Bonytail have been stocked in this reach since 1996; however, these populations have not thrived, and there has been no recruitment (NPS 2003). Only five individuals, all from Cataract Canyon, were collected during surveys by Valdez and Williams from 1985 to 1988 (NRC 1999). The presence of this rare fish near the Moab site has not been confirmed (NRC 1999).

3.1.10.2 Environmental Tolerances

The aquatic environment in the reach of the Colorado River bordering the Moab site is potentially affected by activities at the site. Ground water flow from the pile has introduced chemical and radioactive contaminants into the surface water (see Section 3.1.7.3). Tolerance of the aquatic biota to the contaminants is dependent on their life-stage, location, and duration of exposure. Appendix A1, “Biological Assessment,” provides further information on contaminants and their effects on the aquatic biota.

3.1.11 Terrestrial Ecology

Historically, the entire site has been disturbed from natural events such as floods or from milling operations. At present, the relatively barren terrain of the site limits the potential for terrestrial wildlife habitat, with the exception of the southeasternmost portion of the site, where tamarisk are dominant. Approximately 380 acres of the site do not currently support vegetation. Mature tamarisk, with minimal understory, covers approximately 50 acres of the site east of the tailings pile on the Colorado River floodplain. This area provides some habitat for birds and small mammals. Steep rock mesas dominate the area just west of the site. Low-growing desert shrub communities and low-density piñon-juniper forest are the predominant vegetation types west and north of the site along the transportation routes.

3.1.11.1 Terrestrial Vegetation and Wildlife

The existing vegetation reflects a history of disturbance. Plants observed in April 2003 include spike dropseed (*Sporobolus contractus*), sand dropseed (*Sporobolus cryptandrus*), tamarisk (*Tamarix ramosissima*), black greasewood (*Sarcobatus vermiculatus*), gray rabbitbrush (*Ericameria nauseosa*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), big sagebrush (*Artemisia tridentata*), and galleta (*Pleuraphis jamesii*). The presence of tamarisk and low-density black greasewood indicates that ground water occurs within 20 to 50 ft of the surface.

Vegetation across the Colorado River, including the Matheson Wetlands Preserve, provides more attractive habitat and consists of riparian woodland, grassland, and shadscale (saltbush) communities. Woodland, dominated by native tree species such as black willow (*Salix nigra*) and Fremont cottonwood (*Populus fremontii*), is present in the preserve. Other plants include tamarisk, sedges (*Carex* spp.), bulrush (*Scirpus* spp.), and cattail (*Typha* spp.) (NRC 1999). More than 175 species of birds have been observed at the preserve, and a great blue heron (*Ardea herodias*) rookery is present in its lower end (NRC 1999).

Without the current disturbance, the potential natural vegetation (i.e., vegetation that would occur in the absence of disturbance) and habitat of the upland soils at the site, Nakai sandy loam (see Section 3.1.2), would include grasses such as Indian ricegrass (*Achnatherum hymenoides*)